Chapter 9 - Coastal Branch Aqueduct

Potential Contaminant Source or Watershed Activity	Report Section	Water Quality Parameters							
		TDS/ Salts	Organic Carbon	Bromide	Pesticides	Nutrients	Pathogens	Trace Elements	T&O
Recreation	9.3.1								
Wastewater Treatment/Facilities	9.3.2								
Urban Runoff	9.3.3								
Animal Populations	9.3.4					◒	◒		
Oil Wells and Pipelines	9.3.5								
Agricultural Activities	9.3.6				◒	◒			
Algal Blooms	9.3.7								◒
Unauthorized Activity	9.3.8				◒	◒			
Traffic Accidents/Spills	9.3.9								
Geologic Hazards	9.3.10				○	○	○		
Fires	9.3.11								
Land Use Changes	9.3.12								

Rating symbols:

- ● PCS is a highly significant threat to drinking water quality
- ◒ PCS is a medium threat to drinking water quality
- ⊙ PCS is a potential threat, but available information is inadequate to rate the threat
- ○ PCS is a minor threat to drinking water quality

Blank cells indicate PCS not a source of contaminant

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9.1 INTRODUCTION

Water demand during the 1980s exceeded dependable water supplies by an average 60,000 acre-feet per year in Santa Barbara County and 61,000 acre-feet per year in San Luis Obispo County (CCWA 2000). In both counties, the lowering of groundwater levels has resulted in overdraft conditions and deteriorating water quality for consumers. During the 1987-1992 drought, a number of Central Coast communities had severe water shortages. As a result, voters in both counties approved a referendum in 1991 requiring the San Luis Obispo and Santa Barbara County flood control and water conservation districts to request the California Department of Water Resources (DWR) to complete construction of the Coastal Branch Aqueduct, which was originally begun in 1963. The aqueduct was completed in 1997 and consists of 15 miles of canal and 100 miles of pipeline. The aqueduct supplies communities throughout San Luis Obispo and Santa Barbara counties and supports agriculture in western Kern County.

This chapter describes the State Water Project (SWP) facilities and the major participants in the Coastal Branch Aqueduct (Figure 9-1). Water quality data from the California Aqueduct are compared to data from open-canal sections of the Coastal Branch Aqueduct and the raw and treated water at the Polonio Pass Water Treatment Plant (WTP). Identification of potential contaminant sources was restricted to the initial 15-mile stretch of the Coastal Branch Aqueduct, which is a concrete-lined, trapezoidal canal. All other sections of this aqueduct are pipeline and, therefore, not subject to contamination from activities in the adjacent watershed.

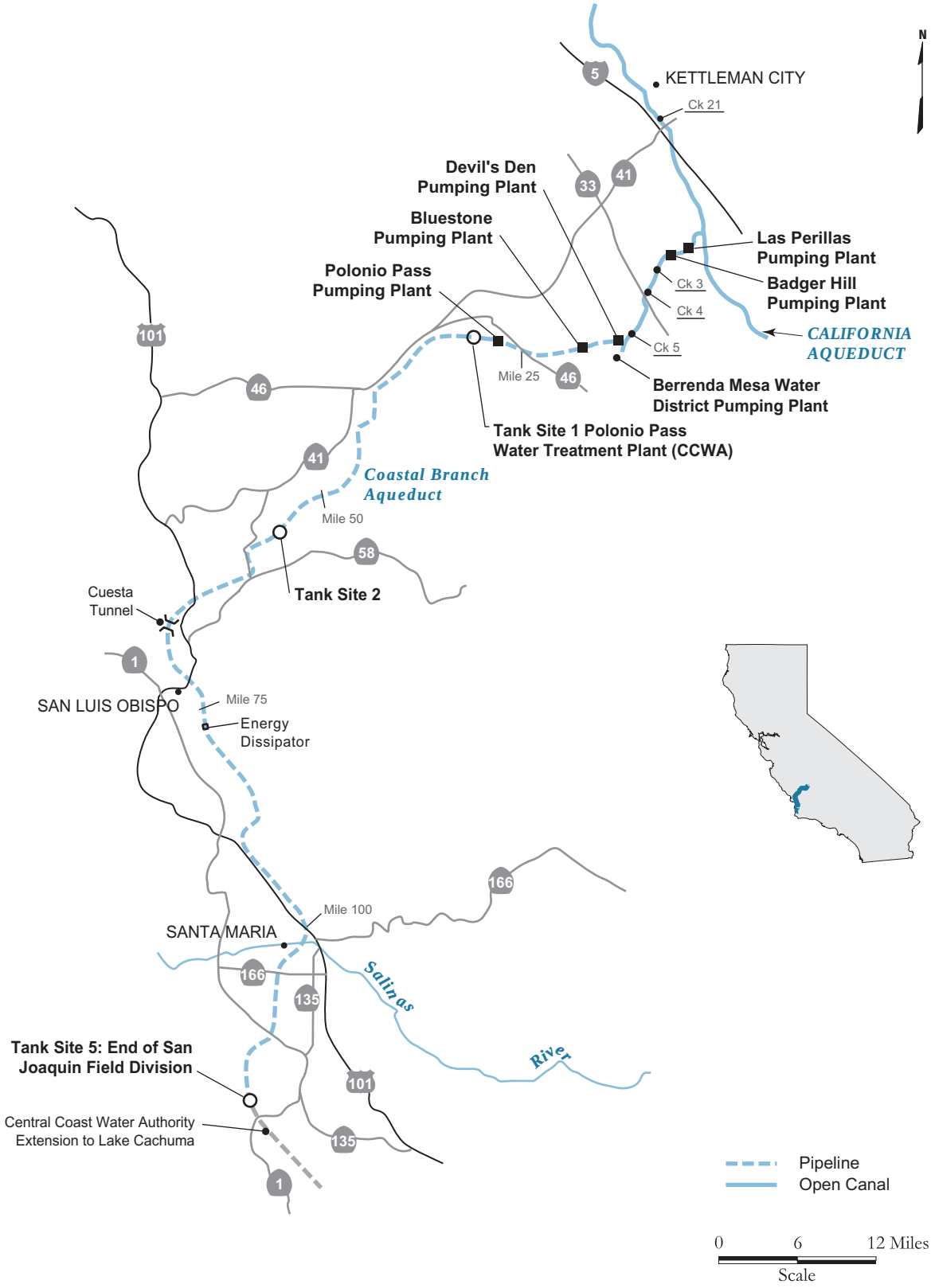
9.2 WATER SUPPLY SYSTEM

9.2.1 DESCRIPTION OF AQUEDUCT AND SWP FACILITIES

The Coastal Branch Aqueduct begins southward from the Kettleman Hills of western Kings County and stretches about 115 miles into southern Santa Barbara County. Figure 9-1 shows the major features of the Coastal Branch Aqueduct.

The branch was constructed in 2 phases. Phase 1, completed in 1968, consists of about 15 miles of canal and 2 pumping plants, Las Perillas and Badger Hill. Phase 2 was constructed between 1993 and 1998 and includes 3 pumping plants—Devil's Den, Bluestone and Polonio Pass—that lift water 1,500 feet through buried pipeline to the Polonio Pass WTP (capacity 43 mgd). Treating water to potable levels at this site near the upstream end of the Coastal Branch offered economies of scale to Central Coast contractors as compared to building a series of smaller WTPs serving individual users. From the Polonio Pass WTP, water is delivered via pipeline to SWP participants in San Luis Obispo and Santa Barbara counties, terminating at a tank site at Vandenberg Air Force Base in western Santa Barbara County. A 42-mile pipeline owned and operated by the Central Coast Water Authority (CCWA) carries water from the tank site to Lake Cachuma; CCWA also owns and operates the regional WTP at Polonio Pass.

Figure 9-1 Coastal Branch Aqueduct



A cooperative group of local water agencies and cities, CCWA formed to construct, manage, and operate local plants for distribution and treatment of State water. CCWA holds water supply agreements with its contractors throughout Santa Barbara County, and as a result the agency is obligated to pay all costs charged for SWP deliveries to the county. On 1 October 1996, the State entered into an agreement with CCWA to have the agency operate and maintain all of the Coastal Branch facilities downstream of the Polonio Pass WTP. Initial deliveries to turnouts along the pipeline commenced on 11 August 1997, and to Lake Cachuma on 20 November 1997. Following are the primary uses of SWP entitlements on the Central Coast:

- To offset groundwater overdrafts,
- To improve water quality for consumers, and
- To provide for future growth consonant with community general plans.

9.2.2 DESCRIPTION OF AGENCIES USING SWP WATER

The Coastal Branch Aqueduct is designed to deliver 4,830 acre-feet per year of SWP water to San Luis Obispo County and 42,986 acre-feet per year to Santa Barbara County (including a 3,908 acre-feet drought buffer). The Berrenda Mesa Water District (western Kern County) operates a takeout near the Devil's Den Pumping Plant. Its entitlement is 11,000 acre-feet, although data on how much water the district withdraws from the Coastal Branch Aqueduct were not available. Tables 9-1 and 9-2 list the major SWP participants in Santa Barbara and San Luis Obispo counties and their SWP allocations.

Table 9-1 Major SWP Participants in Santa Barbara County and their Allocations

Coastal Aqueduct Participant	SWP Allocation (af/yr)
Santa Barbara County (CCWA)	
City of Santa Maria	16,200
Vandenberg Airforce Base	5,500
Goleta Water Dist.	4,500
City of Santa Barbara	3,000
Montecito Water Dist.	3,000
Carpenteria Valley Water Dist.	2,000
Santa Ynez River Water Dist.	2,000
La Cumbre Mutual Water Co.	1,000
City of Buellton	578
City of Guadalupe	550
California Cities Water Co.	500
Morehart Land Co.	200
Santa Barbara Research	50

Table 9-2 Major SWP Participants in San Luis Obispo County and their Allocations

Coastal Aqueduct Participant	SWP Allocation (af/yr)
San Luis Obispo County (CCWA)	
City of Morro Bay	1,313
City of Pismo Beach	1,240
Oceano Community Service Dist.	750
County of San Luis Obispo[a]	725
California Men's Colony (State)	400
San Miguelito Mutual Water Dist.	275
Avila Beach Service Dist.	100
Avila Valley Mutual Water Co.	20
San Luis Coastal School Dist.	7

[a] Includes CSA No. 16-1, Operations Center and Regional Park, and Community College District (Cuesta College).

9.3 POTENTIAL CONTAMINANT SOURCES

9.3.1 RECREATION

There are no recreational activities in the vicinity of the 15-mile open-canal section of the Coastal Branch Aqueduct.

9.3.2 WASTEWATER TREATMENT/FACILITIES

Septic systems are used to collect and treat wastewater from operations at all of the SWP pumping stations along the Coastal Branch Aqueduct and at Polonio Pass WTP. These systems do not pose a significant water quality hazard to the water conveyance system because they are outside drainage areas to the aqueduct. During the reporting period, no problems were reported for the septic systems.

9.3.3 URBAN RUNOFF

Storm runoff is conveyed over the Coastal Branch Aqueduct in 29 pipes and 4 overchutes (Brown and Caldwell 1990). An additional 8 undercrossings provide drainage from surrounding terrain and cattle-grazing zones. There are also 32 drain inlets that convey canal-shoulder runoff into the aqueduct. No spills were reported at any of these locations.

9.3.4 ANIMAL POPULATIONS

Cattle-grazing occurs year round on open-range, nonirrigated pasture in the watershed adjacent to the open canal. In the past, sheep have been reported to also graze in this area. On a field survey conducted 11 July 2000 (Brennan, pers. comm. 2000), it was noted that the potential existed for runoff from

grazing areas to enter the canal at mile 7.13 to 7.25; this problem was also noted in *Sanitary Survey Update 1996*.

In addition, fencing in the area of mile 13.1 was missing, creating the potential for livestock to reach the canal.

9.3.5 OIL WELLS AND PIPELINES

Open sections of Coastal Branch Aqueduct pass through portions of the Devil's Den oil field. Wells can be found along the western side of the canal beginning at the Badger Hill Pumping Plant. Seven petroleum pipelines and 2 natural gas pipelines cross the Coastal Branch Aqueduct (Brown and Caldwell 1990). No spills occurred during the reporting period. Additional information on hydrocarbon and hazardous material sources within areas adjacent to the aqueduct can be found in Appendix G of *Sanitary Survey Update 1996* (DWR 1996).

9.3.6 AGRICULTURAL ACTIVITIES

While most of the area surrounding the canal is used for grazing, various agricultural crops are grown on both sides of the aqueduct. During a July 2000 inspection, agricultural turnouts at mile 9.34 and 4.22 (Green Valley Turnout) apparently lacked backflow prevention devices or air gaps to prevent reverse-flow into the canal. Turnout operators have been observed adding aqueous ammonia to the water at the turnout at mile 9.34. Operating the turnout without reverse-flow protection creates the possibility of ammonia entering the canal.

9.3.7 ALGAL BLOOMS

Instances of taste and odor problems have been reported by CCWA and may be associated with algal blooms in open-canal and forebay sections of the Coastal Branch Aqueduct. The combination of high nutrient levels in SWP water, warm temperatures and long days can produce problem-levels of algal growth under low-flow conditions in the Coastal Branch Aqueduct.

9.3.8 UNAUTHORIZED ACTIVITY

During an inspection conducted 11 July 2000, 2 large tanks (2,000 to 3,000 gallons) were observed at mile 10.4, just outside the aqueduct right of way. The tanks were full of water, which was likely removed from the aqueduct using portable pumps. It was unknown whether these pumps had adequate backflow prevention devices. Lack of such devices can lead to contamination of the aqueduct via cross-contamination or backflow, although no reports of such contamination have been reported.

9.3.9 TRAFFIC ACCIDENTS / SPILLS

Four roadways cross the open section of the Coastal Branch Aqueduct, including 25th Avenue, Barker Road, and Highway 33. There were no reported incidences of hazardous waste spills along these roads.

9.3.10 GEOLOGIC HAZARDS

Both the open canal and pipeline sections of the Coastal Branch Aqueduct pass near the San Andreas Fault. The Kettleman Hills and coastal transverse mountains of central California are among the most earthquake-prone areas of California (Drager and Savage 1999). Very strong earthquakes have occurred in this area including the magnitude 8.0 Fort Tejon event in 1857 and the magnitude 7.5 Kern County event of 1952. Therefore, the potential exists for damage to the Coastal Branch Aqueduct from earth movements.

9.3.11 FIRES

There were no fires of significance during the period of interest.

9.3.12 LAND USE CHANGES

There were no major land use changes during the reporting period other than the completion of the Coastal Branch Aqueduct.

9.4 WATER QUALITY SUMMARY

9.4.1 COASTAL BRANCH AQUEDUCT

During the period of 1996 through 1999, water quality in the Coastal Branch Aqueduct was monitored by DWR at 1 site along the open canal section of the aqueduct, Check 4, and by CCWA at the Polonio Pass WTP. Grab sample data were collected by DWR at Check 4 on a monthly basis from 1996 through 1999 to monitor SWP source waters to the plant. Real-time data for conductivity, turbidity, temperature, and flow were also collected at Check 4 for calendar year 1999. With the exception of color, iron, odor and turbidity, SWP deliveries from the Coastal Branch Aqueduct met all maximum contaminant levels (MCLs) for drinking water (Table 9-3).

Table 9-3 Summary of Selected Constituents in Raw Water at Checks 4 and 21 and Raw and Treated Water at Polonio Pass WTP, 1996 to 1999

Parameter	Units		Treated CCWA PPWTP	Raw SWP @ PPWTP	Raw SWP @ Check 4	Raw SWP @ Check 21
Minerals						
Calcium	mg/L	Range	14 – 27	16 – 28	13 – 42	14 – 70
		Average	19	21	19	20
Chloride	mg/L	Range	23 – 98	30 – 70	21 – 116	20 – 117
		Average	61	52	52	52
TDS	mg/L	Range	157 – 510	187 – 296	137 – 496	137 – 593
		Average	262	243	224	228
Hardness (as $CaCo_3$)	mg/L	Range	60 – 127	86 – 106	61 – 204	65 – 278
		Average	93	96	93	95
Alkalinity (as $CaCo_3$)	mg/L	Range	51 – 95	67 – 83	50 – 108	48 – 100
		Average	75	74	74	70
Specific Conductance	µS/cm	Range	256 – 564	308 – 518	236 – 779	234 – 883
		Average	445	420	408	408
Magnesium	mg/L	Range	6 – 16	8 – 15	7 – 24	7 – 25
		Average	11	12	11	11
Sulfate	mg/L	Range	28 – 112	25 – 65	19 – 233	19 – 298
		Average	45	42	42	43
Turbidity (monthly)	NTU	Range	0.04 – 0.10	3.6 – 9.8	0.0 – 77	2 – 69
		Average	0.06	5.6	12	12
Minor Elements						
Aluminum	mg/L	Range	ND – 0.25	ND – 0.74	NC	0.01 – 0.08
		Average	0.05	0.31	NC	0.02
Arsenic	ppb	Range	ND – 2.1	ND – 3.0	NC	1.0 – 3.0
		Average	0.1	1.1	NC	2.0
Copper	mg/L	Range	ND – 0.03	ND – 0.04	NC	0.00 – 0.01
		Average	0.01	0.00	NC	0.00
Fluoride	mg/L	Range	0.06 – 0.18	0.08 – 0.09	0.0 – 0.2	0.1 – 0.2
		Average	0.08	0.06	0.1	0.1
Iron	ppb	Range	ND	64 – 868	NC	5 – 179
		Average	ND	371	NC	18
Nutrients						
Nitrate (as N)	mg/L	Range	1.8 – 6.5	NC	0.1 – 7.3	0.0 – 5.9
		Average	1.6	1.2	2.4	3.0
Misc.						
Color	color	Range	2 – 6	2 – 22	NC	NC
		Average	2.6	13	NC	NC
pH	pH	Range	7.9 – 8.3	8.2 – 8.9	7.1 – 9.3	6.9 – 8.4
		Average	8.1	8.5	8.1	7.6
Total Organic Carbon	mg/L	Range	NC	NC	NC	2.3 – 6.2
		Average	NC	NC	NC	3.2
Total Trihalomethane	ppb	Range	18 – 38	NC	NC	NC
		Average	27	NC	NC	NC
Bromide	mg/L	Range	NC	NC	NC	0.06 – 0.39
		Average	NC	NC	NC	0.17

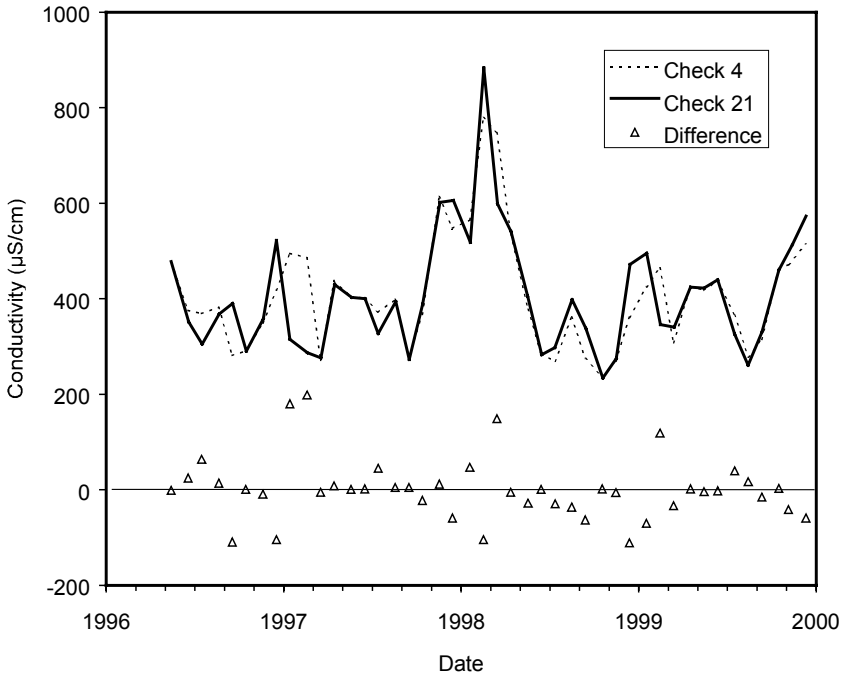
Sources: DWR O&M database, Feb 2001; Central Coast Water Authority
Averages for treated CCWA water are the mean of the annual averages from 1996 through 1999
PPWTP = Polonio Pass Water Treatment Plant NC = Not Collected ND = None Detected

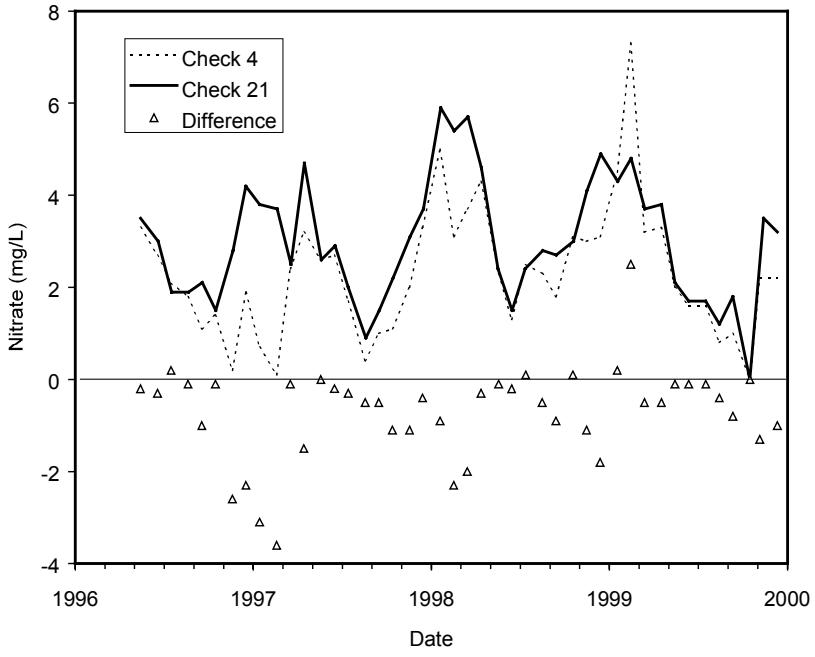
Real-time data collection was halted at Check 4 in early 2000, at the request of CCWA, which felt that the data did not provide sufficient early warning for the Polonio Pass WTP. Plant operators now rely on real-time data from Check 21 on the California Aqueduct near Kettleman City, which is 12.3 miles upstream from the origin of the Coastal Branch.

About 27 miles of open canal separate Check 21 from the pipeline intake of the Coastal Branch Aqueduct located at Devil's Den Pumping Plant. Thus, water quality at Check 21 should provide an accurate depiction of SWP inputs to the Polonio Pass WTP. Water quality data for Check 21 are discussed in detail in Chapter 8. To evaluate the assumption that water quality in the Coastal Branch is similar to that at Check 21, a comparison was made between DWR samples collected within approximately 1 day at both sites.

For all major constituents, for example, TDS, hardness, major cations, there were no significant differences in levels measured at the 2 sampling stations. Data for electrical conductivity (EC) at both Check 4 and Check 21 are presented in Figure 9-2; interstation differences in EC are representative of those for most water quality parameters measured. Differences in EC between Check 21 and Check 4 were slightly greater during low flow periods in fall and winter than in spring and summer when water deliveries in the Coastal Branch were highest. During the early part of 1997 and 1999, time lags on the order of 20 to 45 days were observed in EC levels as water slowly moved from Check 21 to Check 4. These lags suggest that during fall and winter months water is stored for appreciable periods in the Coastal Branch canal and pumping plant forebays before reaching the Polonio Pass WTP.

Figure 9-2 Comparison of Conductivity and Nitrate Values at Checks 4 and 21





During low flow periods, nitrate concentrations in Coastal Branch water declined markedly from levels present in the California Aqueduct (Figure 9-2); these declines are most likely due to nitrate assimilation by attached algae in the canals and forebays. Instances of taste and odor problems in the autumn of 2000 were reported by CCWA and may be associated with algal blooms in open sections of the Coastal Branch Aqueduct. The combination of high nutrient levels in SWP water, warm temperatures, and long days can produce problem-levels of algal growth under low flow conditions in the Coastal Branch Aqueduct. There was 1 instance where Check 4 nitrate exceeded the Check 21 level, 16 February 1999. It is unknown whether the high Check 4 nitrate value was the result of contamination in the canal section of the Coastal Aqueduct or a sampling artifact.

9.4.2 WATER SUPPLY SYSTEMS: POLONIO PASS WTP

Water quality information for finished water at the Polonio Pass WTP was obtained from CCWA and is presented in Table 9-3. The ranges and averages were computed for the period of 1996 through 1999; data for raw SWP water at the plant and at Check 21 and Check 4 are presented for comparison.

For all constituents, CCWA-treated water met MCL values. For comparison, source water from the SWP typically exceeded MCL values for color, iron, odor, and turbidity and approached the MCL for aluminum. Values for all other constituents were below their MCL values in raw SWP deliveries. It is notable that average values for both iron and aluminum at Check 21 are less than 10% of the concentrations measured in SWP deliveries at Polonio Pass WTP. These differences suggest that there may be a source of metals somewhere along the Coastal Branch Aqueduct. Alternately, the concentration differences could result from analytical error at the CCWA laboratory. Average nitrate concentration at the WTP plant was less than half that measured at Check 21 and is indicative of algal growth in open canal and forebay sections of the Coastal Branch Aqueduct.

Total organic carbon (TOC) levels at Check 21 frequently exceeded the proposed drinking water protection standard of 3 mg/L at the export pumps at Banks Pumping Plant. However, total trihalomethane (TTHM) levels in treated water at Polonio Pass WTP ranged from 18 to 38 parts per billion (ppb) (average 27 ppb) for the 3-year period and are within both the current and proposed MCLs of 100 ppb and 80 ppb, respectively. Thus, it appears that current treatment practices at the plant are adequate to address future D/DBP Rules for TOC and TTHM in water with alkalinity in the 60 to 120 mg/L range.

Bromide levels at Check 21 ranged from 0.06 to 0.39 mg/L and exceed the proposed drinking water protection standard of 0.05 mg/L. These constituent levels are likely a reflection of Delta contaminant sources and water quality conditions. Since chlorination is the primary disinfection method used at the Polonio Pass WTP, bromate formation is not a water quality issue at this time and would be a potential problem only if ozonation treatment were employed to meet lower TTHM standards in the future.

9.5 SIGNIFICANCE OF POTENTIAL CONTAMINANT SOURCES

The only part of the Coastal Branch Aqueduct with significant risk of contamination is the initial 15-mile section of open canal. All other portions of the aqueduct are piped and, therefore, have low risk of contamination.

Currently, the major risk for contamination in the open canal section of the aqueduct comes from agricultural turnouts that do not employ backflow protection. In particular, withdrawals of water between miles 9.34 and 10.5 (between Check 4 and Check 5) are potential sources of contaminants such as agricultural chemicals and vehicle oil and gasoline. This section of the canal was identified as a potential contaminant source in the *Sanitary Survey Update 1996* as well. Based on the comparison between water quality at Check 21 and Check 4, activities at the turnouts do not appear to result in gross contamination of the canal. However, smaller transient events may still occur. There were no reported incidences of contamination from aqueduct under- and overcrossings, and the potential risks appear small.

9.6 WATERSHED MANAGEMENT PRACTICES AND RECOMMENDATIONS

Other than copper treatments in open canal sections and forebays along the Coastal Branch Aqueduct, there are no current management practices that are likely to impact water quality. CCWA requests that DWR ensures that all turnouts, whether at permanent or temporary stations, have adequate backflow prevention devices.

References

LITERATURE CITED

Brown and Caldwell Consultants. 1990 Oct. *Sanitary Survey of the State Water Project*. Final report. Conducted at the request of the California Department of Health Services and the State Water Contractors.

[CCWA] Central Coast Water Authority. 2000. "The State Water Project in Santa Barbara County." <http://www.ccwa.com/history/> Accessed Feb 2001.

Drager D, Savage B. 1999. "Aftershocks of the 1952 Kern County, California, earthquake sequence." *Bull Seismol Soc Am*. 89:1094-1108.

[DWR] California Department of Water Resources, Division of Planning and Local Assistance, Water Quality Assessment Branch. 1996 May. *California State Water Project sanitary survey update report 1996*.

PERSONAL COMMUNICATIONS

Brennan, William, Central Coast Water Authority. 2000. Memorandum. Jul 11.